

COURSE OUTLINE

THE NEED FOR ENERGY MANAGEMENT

Building energy cost control
Utility DSM programs and deregulation – efficiency and peak demand reduction
Commercial business energy cost control
Industrial plant operation improvement

- Reducing energy costs
- Reducing environmental emissions
- Improving product quality
- Improving plant productivity

CONDUCTING AN ENERGY AUDIT

Purpose of the energy audit
Facility description and data needs
Major systems in the facility
Data forms for recording information
Collecting the actual data
Identification of preliminary energy management opportunities

ENERGY AUDIT INSTRUMENTATION

The need for instrumentation
Light level meters
Electric meters

- Voltages, current, power, energy, power factor

Temperature-measuring instruments
Combustion efficiency measurement
Air flow and air leak measurement
Thermography
Data logging

ENERGY CODES AND STANDARDS

Building codes
ASHRAE standards (62, 15, 3, 90.1)
ASME, IEEE, and other standards
Federal legislation

- NECPA, PURPA, NGPA, CAAA, NEPA of 1992

CFC replacements

- Montreal Protocol, Global Climate Change

National Energy Policy Act of 2005
Proposed tax incentives 2002

BUILDING ENERGY USE AND PERFORMANCE

Fuel types and costs
Energy content of fuels
Energy conversion factors
Building envelope
Natural gas purchasing
Retail wheeling of electricity
Major building energy use systems

ENERGY ACCOUNTING IN BUILDINGS AND FACILITIES

Energy use index, energy cost index
Where energy is used in facilities
Lighting and HVAC energy use

ENERGY RATE STRUCTURES

Identifying types of energy used
Electric rates, gas rates
Oil, coal, and other rates
Steam and hot water rates
Factors in controlling fuel costs
Utility incentive programs

ELECTRIC RATE STRUCTURES

Short history of electric rates
The difference between power and energy

energy

Electric meters
Components of electric rates
Example rate structures
Factors in controlling electric costs
Electric utility incentive programs
Special schedules (interruptible, TOU, real-time pricing)

ECONOMIC ANALYSIS OF ALTERNATIVE INVESTMENTS

Economic decision analysis
Simple economic measures
The time value of money
Present and future values
Cost and benefit analysis
After tax cash flows

ALTERNATIVE FINANCING

Role of performance contracting
Different sources (loans, stock sales, bonds, etc.)
FEMP and alternative financing
True lease, capital lease, bonds, etc.

WASTE HEAT RECOVERY

Objectives: design criteria
Types and maintenance of heat exchangers
Recuperators; economizers

LIFE CYCLE COSTING

Concept of life cycle costing
Purchase costs vs. operating costs
Example analyses
Government standards – FEMP

FUEL SUPPLY AND FUEL SWITCHING

Alternative fuel choices
Technology choices

- HVAC systems, boilers, heaters, industrial processes

Benefits of deregulation – electric, gas, and oil

ELECTRICAL ENERGY MANAGEMENT

Peak load reduction
Power factor improvement
Energy management control systems
Load management
Harmonics and other power quality issues

LIGHTING

Basics of lighting and current lighting technologies
New lighting technologies
Economic evaluation of example lighting improvements
Lighting standards
EPA Green Lights program
T12, T8, T5 lamps
Compact fluorescents
HID, sulfur lamps

MOTORS AND ADJUSTABLE SPEED DRIVES

How motors work
High-efficiency motors
Examples of cost-effective motor changes
Use of adjustable speed drives
Example of cost-effective ASD use
Improved motor belts and drives
Compressed air management
Adjustable speed drive alternatives:

eddy current clutches, permanent magnet clutches, variable frequency drives, inlet and outlet vane control, etc.

HVAC SYSTEM

Types of HVAC systems and new technologies
The vapor-compression cycle
Air conditioning loads
Chiller improvement example
Control, thermal storage, absorption systems

CONTROLS AND ENERGY MANAGEMENT

Night set back
Optimum start/stop
Enthalpy economizers
Temperature resets
PID controls, pneumatic controls
Control characteristics
DDC

INSULATION

Types of insulation
Heat flow calculations
Economic levels of insulation
Passive thermal energy
Process insulation

GREEN BUILDINGS, LEED®, AND ENERGY STAR

Green buildings and sustainable design
U.S. Green Buildings Council and LEED®
LEED® certification: LEED®-NC, EB, CI, CS
ASHRAE 90.1 Energy Cost Budget Method
Energy and atmosphere, indoor environmental quality, water efficiency
EPA and the ENERGY STAR program
ENERGY STAR Building Label
Energy performance ratings and profile manager

BOILERS AND STEAM GENERATION

Basics of combustion systems

- Excess air control

Boiler efficiency improvement

- Blowdown management, condensate return, turbulators

Combustion controls
Waste heat recovery
Steam traps – purpose and testing
Process insulation
Example of boiler improvement

COGENERATION (CHP)

What is cogeneration
Types of cogeneration cycles
Examples of cost-effective use of cogen
QF's and deregulation
Use of waste for fuel
Fuel cells, microturbines, etc.

MAINTENANCE

Maintenance management systems
Monitoring for maintenance
Infrared photography for maintenance
Cost of:

- Air, steam, gas leaks; uninsulated surfaces

ALTERNATIVE FINANCING

Different financing methods
Attributes of each method
After-tax cash flow analysis